

<b>Taxon:</b> <i>Agathis australis</i> (D. Don) Steud.	<b>Family:</b> Araucariaceae
<b>Common Name(s):</b> kauri New Zealand kauri	<b>Synonym(s):</b> <i>Dammara australis</i> D. Don

<b>Assessor:</b> Chuck Chimera	<b>Status:</b> In Progress	<b>End Date:</b> 28 May 2024
<b>WRA Score:</b> -8.0	<b>Designation:</b> L	<b>Rating:</b> <span style="background-color: yellow;">Low Risk</span>

**Keywords:** Slow-Growing, Unarmed Tree, Shade-Intolerant, Moderately Flammable, Wind Dispersed

Qsn #	Question	Answer Option	Answer
101	Is the species highly domesticated?	y = -3, n = 0	n
102	Has the species become naturalized where grown?		
103	Does the species have weedy races?		
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	0 = low, 1 = intermediate, 2 = high (see Appendix 2)	Intermediate
202	Quality of climate match data	0 = low, 1 = intermediate, 2 = high (see Appendix 2)	High
203	Broad climate suitability (environmental versatility)	y = 1, n = 0	n
204	Native or naturalized in regions with tropical or subtropical climates	y = 1, n = 0	y
205	Does the species have a history of repeated introductions outside its natural range?	y = -2, ? = -1, n = 0	y
301	Naturalized beyond native range	y = 1*multiplier (see Appendix 2), n = question 205	n
302	Garden/amenity/disturbance weed	y = 1*multiplier (see Appendix 2), n = 0	n
303	Agricultural/forestry/horticultural weed	y = 2*multiplier (see Appendix 2), n = 0	n
304	Environmental weed	y = 2*multiplier (see Appendix 2), n = 0	n
305	Congeneric weed	y = 1*multiplier (see Appendix 2), n = 0	n
401	Produces spines, thorns or burrs	y = 1, n = 0	n
402	Allelopathic	y = 1, n = 0	y
403	Parasitic	y = 1, n = 0	n
404	Unpalatable to grazing animals	y = 1, n = -1	n
405	Toxic to animals	y = 1, n = 0	n
406	Host for recognized pests and pathogens	y = 1, n = 0	n
407	Causes allergies or is otherwise toxic to humans	y = 1, n = 0	n
408	Creates a fire hazard in natural ecosystems	y = 1, n = 0	y
409	Is a shade tolerant plant at some stage of its life cycle	y = 1, n = 0	n
410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y = 1, n = 0	y

Qsn #	Question	Answer Option	Answer
411	Climbing or smothering growth habit	y = 1, n = 0	n
412	Forms dense thickets	y = 1, n = 0	y
501	Aquatic	y = 5, n = 0	n
502	Grass	y = 1, n = 0	n
503	Nitrogen fixing woody plant	y = 1, n = 0	n
504	Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)	y = 1, n = 0	n
601	Evidence of substantial reproductive failure in native habitat	y = 1, n = 0	n
602	Produces viable seed	y = 1, n = -1	y
603	Hybridizes naturally	y = 1, n = -1	n
604	Self-compatible or apomictic	y = 1, n = -1	n
605	Requires specialist pollinators	y = -1, n = 0	n
606	Reproduction by vegetative fragmentation	y = 1, n = -1	n
607	Minimum generative time (years)	1 year = 1, 2 or 3 years = 0, 4+ years = -1	>3
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	y = 1, n = -1	n
702	Propagules dispersed intentionally by people	y = 1, n = -1	y
703	Propagules likely to disperse as a produce contaminant	y = 1, n = -1	n
704	Propagules adapted to wind dispersal	y = 1, n = -1	y
705	Propagules water dispersed	y = 1, n = -1	n
706	Propagules bird dispersed	y = 1, n = -1	n
707	Propagules dispersed by other animals (externally)	y = 1, n = -1	n
708	Propagules survive passage through the gut	y = 1, n = -1	n
801	Prolific seed production (>1000/m <sup>2</sup> )	y = 1, n = -1	n
802	Evidence that a persistent propagule bank is formed (>1 yr)	y = 1, n = -1	n
803	Well controlled by herbicides		
804	Tolerates, or benefits from, mutilation, cultivation, or fire	y = 1, n = -1	n
805	Effective natural enemies present locally (e.g. introduced biocontrol agents)		

Supporting Data:

Qsn #	Question	Answer
101	Is the species highly domesticated?	n
	Source(s)	Notes
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	[No evidence] "Major research needs are for genetic improvement of trees for planting and investigation of heartwood formation." ... "No marked differences in growth of trees from different provenances have been recorded. Superior growth and vigour of some individual trees has been observed but no breeding programme has been undertaken. Techniques are available for production of cuttings and grafts and have been explored for micropropagation (Ecroyd et al., 1993). Grafts of <i>A. australis</i> planted in pumice soil in a Rotorua garden have produced trees 13.5 m in height and 26 cm diameter in 27 years. The scions were taken from the lateral branches of an exceptionally fast-growing young tree and grew laterally on seedlings for several years before growing into trees with upright stems (DJ Preest, personal communication)."
102	Has the species become naturalized where grown?	
	Source(s)	Notes
	WRA Specialist. (2024). Personal Communication	NA
103	Does the species have weedy races?	
	Source(s)	Notes
	WRA Specialist. (2024). Personal Communication	NA
201	Species suited to tropical or subtropical climate(s) - If island is primarily wet habitat, then substitute "wet tropical" for "tropical or subtropical"	Intermediate
	Source(s)	Notes
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"The climate of the region in which <i>A. australis</i> grows naturally has been described as warm temperate with subtropical affinities (Whitmore, 1977) and is generally humid with well-distributed rainfall and occasional light frosts."
202	Quality of climate match data	High
	Source(s)	Notes
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	
203	Broad climate suitability (environmental versatility)	n
	Source(s)	Notes
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"The natural distribution of <i>A. australis</i> is confined to the warm, humid, region of the northern part of the North Island of New Zealand, where frosts are infrequent and not severe. Latitude between 34°S and 38°S"
204	Native or naturalized in regions with tropical or subtropical climates	y

Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	[Marginally subtropical] "The natural distribution of <i>A. australis</i> is confined to the warm, humid, region of the northern part of the North Island of New Zealand, where frosts are infrequent and not severe. Latitude between 34°S and 38°S" ,, "The climate of the region in which <i>A. australis</i> grows naturally has been described as warm temperate with subtropical affinities (Whitmore, 1977) and is generally humid with well-distributed rainfall and occasional light frosts. However, <i>A. australis</i> can be established well outside its natural range, provided that seedlings are protected from frost and wind. Near-optimum growth has been achieved by trees planted in mild, coastal localities and inland at Rotorua (300 m altitude)."

205	<b>Does the species have a history of repeated introductions outside its natural range?</b>	y
	<b>Source(s)</b>	<b>Notes</b>
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Seed of <i>A. australis</i> has been sent to a number of warm temperate and tropical countries but reliable records of successful establishment are not available. <i>A. australis</i> has been grown in Fiji, Malawi, South Africa and Zimbabwe, and Whitmore (1977) records a small trial plot of <i>A. australis</i> in Kenya. Francis (1988) reported on the growth <i>A. australis</i> in Puerto Rico. A 40- to 50-year-old plantation has been recorded from northern Spain alongside other endemic New Zealand conifers (J. Purey Cust, personal communication)."
	Randall, R.P. (2007). The introduced flora of Australia and its weed status. CRC for Australian Weed Management, Glen Osmond, Australia	Reported from Australia, but not listed as a weed
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	Reported from South Africa, but not listed as a weed.

301	<b>Naturalized beyond native range</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Gallaher, T.J., Brock, K., Kennedy, B.H., Imada, C.T., Imada, K., & Walvoord, N. (2024). Plants of Hawai'i. <a href="http://www.plantsofhawaii.org">http://www.plantsofhawaii.org</a> . [Accessed 28 May 2024]	"Only found in cultivation"
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

302	<b>Garden/amenity/disturbance weed</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

303	<b>Agricultural/forestry/horticultural weed</b>	n
	<b>Source(s)</b>	<b>Notes</b>
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence

Qsn #	Question	Answer
304	Environmental weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence
305	Congeneric weed	n
	Source(s)	Notes
	Randall, R.P. (2017). A Global Compendium of Weeds. 3rd Edition. Perth, Western Australia. R.P. Randall	No evidence
	Richardson, D. M., & Rejmánek, M. 2004. Conifers as invasive aliens: a global survey and predictive framework. Diversity and Distributions, 10(5-6): 321-331	No evidence
401	Produces spines, thorns or burrs	n
	Source(s)	Notes
	Allan, H.H. (1982). Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand	[No evidence] "Monoec. tree, resiniferous, up to 30 m. or rarely up to 60 m., trunk up to 3 m. diam., occ. up to 7 m.; bark bluish grey, falling in large, thick flakes. Lvs alt. to subopp., sessile, thick, coriac., parallel-veined; of juveniles lanceolate, 5-10 cm. x 5-12 mm.; of adults 2-3.5 cm. long, about oblong, obtuse. Male strobili 2-5 cm. long, stout, cylindrical; female cones subglobose, 5-7.5 cm. diam.; carpodia broad above, narrowing to base, rather thin, deciduous, uniovulate. Seeds ovate in outline, compressed, winged."
402	Allelopathic	y
	Source(s)	Notes
	Wyse, S. V., & Burns, B. R. (2013). Effects of <i>Agathis australis</i> (New Zealand kauri) leaf litter on germination and seedling growth differs among plant species. New Zealand Journal of Ecology, 3 (2): 178-183	"Under a broad definition of allelopathy, encompassing allelochemical interactions with soil ecological processes (Inderjit & Weiner 2001), <i>A. australis</i> can be seen to have an indirect allelopathic effect on forest plants in its vicinity through the low pH of the organic soil formed from <i>A. australis</i> litter. In addition, the results of <i>Lactuca sativa</i> show that phytotoxic compounds may be present in the soil in concentrations that directly affect sensitive species. However, we did not find any direct allelopathic effects of <i>A. australis</i> soil separate to a pH-mediated effect on the three forest species investigated here. To tease out the relative roles of direct and indirect allelopathic effects of <i>A. australis</i> within the ecosystem, future work should investigate the influence of these factors on further species, and in field conditions. Future work should also aim to identify the compounds involved in producing these allelopathic effects, and examine the modes of action by which the compounds may directly affect germination and plant growth (Inderjit & Callaway 2003)."
403	Parasitic	n
	Source(s)	Notes
	Allan, H.H. (1982). Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand	[No evidence] "Monoec. tree, resiniferous, up to 30 m. or rarely up to 60 m., trunk up to 3 m. diam., occ. up to 7 m.; bark bluish grey, falling in large, thick flakes."
404	Unpalatable to grazing animals	n

Qsn #	Question	Answer
	Source(s)	Notes
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. New Zealand Journal of Botany, 20(1): 17-36	"Brush-tailed possums ( <i>Trichosurus vulpecula</i> Kerr) have been reported to persistently browse seedlings and damage the bark on young trees (R. C. Lloyd, pers. comm.)." ... "Mice ( <i>Mus musculus</i> L.) and possibly rats ( <i>Rattus rattus</i> L.) are thought to eat considerable quantities of seed and recently germinated seedlings (I. L. Barton, pers. comm.). The terminal shoots of young planted seedlings have been reported to be eaten by either rabbits ( <i>Oryctolagus cuniculus</i> L.) or hares ( <i>Lepus europaeus</i> Pallas) in the Kauaeranga Valley (Bellamy 1951) and the Hunua Range (I. L. Barton, pers. comm.)." ... "Goats ( <i>Capra hircus</i> L.) are present in nearly all kauri forests and can damage seedlings and saplings by browsing on the foliage and shoots. The terminal shoot is often damaged and sometimes the bark is stripped off (R. C. Lloyd, pers. comm.). I. L. Barton (pers. comm.) found that recently planted nursery-raised seedlings were killed by goats in the Hunua Ranges, particularly in late summer and autumn. Damage is usually local, particularly around sunny faces. Red deer ( <i>Cervus elaphus</i> L.) are not common in the areas containing kauri forest and the only reports of damage have been to planted seedlings in the Rotorua region. Cattle ( <i>Bos taurus</i> L.), horses ( <i>Equus caballus</i> L.), and pigs ( <i>Sus scrofa</i> L.) can damage natural regeneration (R. C. Lloyd, pers. comm.)"
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Goats ( <i>Capra hircus</i> ) and the brush-tailed possum ( <i>Trichosurus vulpecula</i> ) can cause local damage to seedlings and saplings."

405	Toxic to animals	n
	Source(s)	Notes
	Wagstaff, D.J. (2008). International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. New Zealand Journal of Botany, 20(1): 17-36	No evidence. Browsed by a number of mammal species

406	Host for recognized pests and pathogens	n
	Source(s)	Notes
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"No pathogen or pest can be rated at more than low or local importance for <i>A. australis</i> beyond the seedling stage within natural or planted stands. An account identifying fungal and insect species that have caused local damage is given by Ecroyd (1982). Damping off and root rot of <i>A. australis</i> seedlings in nursery beds with poorly-drained soil caused some problems in earlier attempts to raise bare-rooted seedlings for planting out, but such problems with container grown seedlings are not recorded. There is some unpublished evidence that death or dieback of old <i>A. australis</i> on flat ridge tops in the forest sanctuary of Waipoua has been associated with unusually wet summers and the presence of <i>Phytophthora cinnamomi</i> ."

407	Causes allergies or is otherwise toxic to humans	n
	Source(s)	Notes

Qsn #	Question	Answer
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	[Useful timber tree. No reports of toxicity] "The heartwood from mature trees of <i>A. australis</i> had a deserved reputation as one of the finest softwoods of the world. Little heartwood is now available from harvesting of old trees, but wood of good quality is salvaged from old stumps, fallen trees and recycled timber. Wood recovered from ancient logs preserved in swamps is highly valued for craft work owing to its colours and lustre, but its mechanical properties have declined (Clifton, 1990). The wood of second-growth <i>A. australis</i> has a high proportion of sapwood and its properties are not the same as those from old-growth trees."
	Wagstaff, D.J. (2008). International poisonous plants checklist: an evidence-based reference. CRC Press, Boca Raton, FL	No evidence

408	Creates a fire hazard in natural ecosystems	y
	Source(s)	Notes
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. New Zealand Journal of Botany, 20(1): 17-36	"Fires have been the major cause of destruction to stands of kauri over the past 150 years (Reed 1953). The mound of debris (gum, bark, and leaves) at the base of a mature kauri is inflammable during dry periods and if it catches fire the tree is usually killed (Kensington 1909)."
	Fogarty, L.G. 2001. A flammability guide for some common New Zealand native tree and shrub species. Forest Research Bulletin No. 197, Forest and Rural Fire Scientific and Technical Series, Report No. 6. New Zealand Fire Service Commission and National Rural Fire Authority, Wellington.	"Moderate flammability: partially ignites in Moderate conditions and burns readily in High to Very High fire danger conditions." ... "Appendix 1. Flammability guide for 42 native New Zealand trees and shrubs - alphabetical list of species with flammability class" [ <i>Agathis australis</i> - Flammability class = Moderate]

409	Is a shade tolerant plant at some stage of its life cycle	n
	Source(s)	Notes
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	" <i>A. australis</i> is shade tolerant only in the small seedling stage when shelter is required and seedlings are prone to desiccation. Full overhead light is required from the sapling stage for best growth."
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. New Zealand Journal of Botany, 20(1): 17-36	"Well-established kauri seedlings can persist in shade but generally stagnate unless further light is obtained (Beveridge 1977)."

410	Tolerates a wide range of soil conditions (or limestone conditions if not a volcanic island)	y
	Source(s)	Notes
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Soil descriptors - Soil texture: light; medium; heavy - Soil drainage: free; impeded - Soil reaction: acid - Special soil tolerances: infertile - Soil types: clay soils; sandy soils; silty soils; subtropical soils; podzols; podzoluvisols; cambisols"  " <i>A. australis</i> grows naturally on a wide range of soils which are generally infertile, and on some parent materials soils can become leached and podsolized beneath the mor-type humus built up beneath mature trees."

411	Climbing or smothering growth habit	n
-----	-------------------------------------	---



Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Allan, H.H. (1982). Flora of New Zealand, Volume I: Indigenous Tracheophyta - Psilopsida, Lycopsidea, Filicopsida, Gymnospermae, Dicotyledons. First electronic edition. Landcare Research, Lincoln, New Zealand	"Monoec. tree, resiniferous, up to 30 m. or rarely up to 60 m., trunk up to 3 m. diam., occ. up to 7 m.; bark bluish grey, falling in large, thick flakes."
412	<b>Forms dense thickets</b>	<b>y</b>
	<b>Source(s)</b>	<b>Notes</b>
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	[Able to form pure stands in native range] "Forests with <i>A. australis</i> in pure stands, as groves or scattered trees, once covered an area of about 1,000,000 ha or more but destruction by fire, uncontrolled logging and land clearance for farming has reduced the 'kauri estate' to some 7000 ha of old growth (virgin) forest, now mainly in reserves and 60,000 ha of scrub and secondary forest with regeneration of <i>A. australis</i> (Halkett and Sale, 1986)." ... "Dense stands of mature <i>A. australis</i> tend to occur on ridges, upper slopes and plateaux, but in fire-induced secondary forest, regeneration of <i>A. australis</i> can be widespread on most types of terrain, although less frequently on fertile valley floors."
501	<b>Aquatic</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	[Terrestrial tree] "Vegetation types: broadleaved evergreen forests; coniferous forests; dunes; rain forests; secondary forests"
502	<b>Grass</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	USDA, Agricultural Research Service, National Plant Germplasm System. (2024). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. <a href="https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch">https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch</a> . [Accessed 28 May 2024]	"Family: Araucariaceae"
503	<b>Nitrogen fixing woody plant</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	USDA, Agricultural Research Service, National Plant Germplasm System. (2024). Germplasm Resources Information Network (GRIN-Taxonomy). National Germplasm Resources Laboratory, Beltsville, Maryland. <a href="https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch">https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch</a> . [Accessed 28 May 2024]	[No evidence] "Family: Araucariaceae"
504	<b>Geophyte (herbaceous with underground storage organs -- bulbs, corms, or tubers)</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>



Qsn #	Question	Answer
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Some of this section is based on the detailed account by Ecroyd (1982). The mature trees have straight, untapered, cylindrical stems with flaking bark, free from branches or epiphytes for 12-25 m. Crowns are massive with upward-arching branches producing flat or slightly-rounded tops. Total heights reach 30-50 m. " ... "The root system of mature trees is extensive with lateral roots often reaching beyond the crown spread. Deeply penetrating 'peg' roots descend from the laterals, giving firm anchorage so that trees are generally windfirm until senescence. Taproots disappear in juvenile trees. Fine feeding roots are superficial in layers of raw humus and litter, and bear nodules containing endophytic mycorrhizas (discussed in Ecroyd, 1982)."

601	Evidence of substantial reproductive failure in native habitat	n
	Source(s)	Notes
	Farjon, A. (2010). A Handbook of the World's Conifers. Volume 1. Koninklijke Brill NV, Leiden, The Netherlands	[No evidence currently, but population reduction may make species vulnerable] "This regeneration is possible in ecologically suitable locations, within some 80,000 ha of existing forest reserves." ... "If IUCN Red List criteria were strictly applied to this history of reduction of population size (A criterion), <i>A. australis</i> would fulfill the criteria for a listing as (at least) Endangered (EN), even though the causes of decline have now ceased, because the reduction amounts to more than 70% over the last three generations (of mature trees)."

602	Produces viable seed	y
	Source(s)	Notes
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Viable seed is produced from cones on open-grown trees from an age of about 30 years. Seed crops are annual but variable in quantity and viability of seed. Seed-bearing cones break up on the tree when ripe in early autumn, some 2 years after cone initiation."

603	Hybridizes naturally	n
	Source(s)	Notes
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. New Zealand Journal of Botany, 20(1): 17-36	"There is no record of hybridisation of <i>A. australis</i> with other <i>Agathis</i> species; however, I know of only 2 other species, <i>A. robusta</i> (C. Moore ex F. Muell.) F. M. Bail. and <i>A. microstachya</i> J. F. Bail. et C. T. White, which have grown to maturity in New Zealand."

Qsn #	Question	Answer
604	Self-compatible or apomictic	n
	<b>Source(s)</b>	<b>Notes</b>
	Owens, J. N., Catalano, G. L., Morris, S. J., & Aitken-Christie, J. (1995). The reproductive biology of Kauri ( <i>Agathis australis</i> ). I. Pollination and prefertilization development. <i>International Journal of Plant Sciences</i> , 156 (3): 257-269	[Selfing results in embryo abortion] "In this study only three of the 10 trees originally selected produced enough filled seed to warrant collections during the second year, when embryos develop, and only one tree was a good seed producer." ... "The close spacing of trees at the collection site would result in low pollen-cone production, poor pollen dispersal, and high rates of selfing. All of these allow normal first-year seed-cone and ovule development, which do not require the presence of pollen or cross pollen but result in ovule abortion at fertilization or later embryo abortion and ultimately empty seeds (Owens and Blake 1985). Correcting this through supplemental pollination would be difficult in Kauri because trees are generally large before they become reproductive, and pollen cones, although they are large and produce abundant pollen, are not numerous and are scattered in the crown, making pollen-cone collection for pollen extraction difficult."
605	Requires specialist pollinators	n
	<b>Source(s)</b>	<b>Notes</b>
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. <i>New Zealand Journal of Botany</i> , 20(1): 17-36	"Pollination The ovules are wind pollinated."
606	Reproduction by vegetative fragmentation	n
	<b>Source(s)</b>	<b>Notes</b>
	CAB International. (2005). <i>Forestry Compendium</i> . CAB International, Wallingford, UK	"- Vegetative propagation by cuttings; grafting"
607	Minimum generative time (years)	>3
	<b>Source(s)</b>	<b>Notes</b>
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. <i>New Zealand Journal of Botany</i> , 20(1): 17-36	"Seed crops are usually annual. Cones may be produced after age 15 -50 years depending on the crown development of an individual tree. R. C. Lloyd (pers. comm.) noted planted trees bearing cones at age 20 years in Raetea State Forest and at Cornwall Park, Auckland, but there are usually few viable seeds in cones from young trees. Trees planted as far south as Dunedin have borne cones with some viable seed."
	CAB International. (2005). <i>Forestry Compendium</i> . CAB International, Wallingford, UK	"Viable seed is produced from cones on open-grown trees from an age of about 30 years."
701	Propagules likely to be dispersed unintentionally (plants growing in heavily trafficked areas)	n
	<b>Source(s)</b>	<b>Notes</b>
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. <i>New Zealand Journal of Botany</i> , 20(1): 17-36	[No evidence. Seeds lack means of external attachment] "Seeds, One to each scale, ovate in outline, compressed, each usually with a single wing" ... "Dispersal of seed The seed is dispersed by wind and gravity."
702	Propagules dispersed intentionally by people	y

Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Staples, G.W. & Herbst, D.R. (2005). A Tropical Garden Flora - Plants Cultivated in the Hawaiian Islands and Other Tropical Places. Bishop Museum Press, Honolulu, HI	"New Zealand kauri was probably first introduced to Hawaii by Dr. William Hillebrand in the mid 1850s."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Seed of <i>A. australis</i> has been sent to a number of warm temperate and tropical countries but reliable records of successful establishment are not available. <i>A. australis</i> has been grown in Fiji, Malawi, South Africa and Zimbabwe, and Whitmore (1977) records a small trial plot of <i>A. australis</i> in Kenya. Francis (1988) reported on the growth <i>A. australis</i> in Puerto Rico. A 40- to 50-year-old plantation has been recorded from northern Spain alongside other endemic New Zealand conifers (J. Purey Cust, personal communication)."

703	Propagules likely to disperse as a produce contaminant	n
	<b>Source(s)</b>	<b>Notes</b>
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. New Zealand Journal of Botany, 20(1): 17-36	[No evidence. Unlikely given long time to reproductive maturity & limited dispersibility of seed] "Cones may be produced after age 15-50 years depending on the crown development of an individual tree." ... "The seed is dispersed by wind and gravity. The female cone usually disintegrates on the tree at maturity, allowing the seed to fall freely and perhaps to be blown away by wind."

704	Propagules adapted to wind dispersal	y
	<b>Source(s)</b>	<b>Notes</b>
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. New Zealand Journal of Botany, 20(1): 17-36	"Dispersal of seed The seed is dispersed by wind and gravity. The female cone usually disintegrates on the tree at maturity, allowing the seed to fall freely and perhaps to be blown away by wind. Mirams (1957) experimented with kauri seed in a wind tunnel and measured wind speed near a large kauri in the Waitakere Ranges. He concluded that every day there would be winds of greater speed than the 1.0- 1.2 mlsec he found necessary to keep seeds airborne. R. C. Lloyd (pers. comm.) states that instances are known of seed dispersal up to 1.5 km."
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	[Shirt distances] "Female cones subglobose 5-7.5 cm diameter when ripe in late summer, producing single-winged seed." ... "The seed is relatively heavy for distant wind dispersal, usually falling from 20-100 m from tree crowns, or occasionally much further in freak winds."

705	Propagules water dispersed	n
	<b>Source(s)</b>	<b>Notes</b>
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. New Zealand Journal of Botany, 20(1): 17-36	"Dispersal of seed The seed is dispersed by wind and gravity."

Qsn #	Question	Answer
706	Propagules bird dispersed	n
	Source(s)	Notes
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. New Zealand Journal of Botany, 20(1): 17-36	[Not fleshy-fruited. Some birds act as seed predators] "Seeds, One to each scale, ovate in outline, compressed, each usually with a single wing" ... "Dispersal of seed The seed is dispersed by wind and gravity." ... "Birds Kakas break up kauri cones using their strong beaks and eat the seeds (Oliver 1955). They have also been observed nipping off immature cones. Eastern rosellas ( <i>Platyercus eximus</i> Shaw) eat the seeds from both ripe and immature cones (R. C. Lloyd, pers. comm.)."
707	Propagules dispersed by other animals (externally)	n
	Source(s)	Notes
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. New Zealand Journal of Botany, 20(1): 17-36	[No evidence. Seeds lack means of external attachment] "The seed is dispersed by wind and gravity."
708	Propagules survive passage through the gut	n
	Source(s)	Notes
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. New Zealand Journal of Botany, 20(1): 17-36	"The seed is dispersed by wind and gravity." ... "The seed is edible to a variety of animals and under nursery conditions mice have eaten the embryo and endosperm of seed just after sowing, and crickets ( <i>Teleogryllus commodus</i> Walker) have damaged the seeds enough to prevent germination (A. J. Dakin, pers. comm.). Mirams (1957) suggested that wetas ( <i>Hemideina thoracica</i> White) eat much seed and Oliver (1955) reported that kaka ( <i>Nestor meridionalis septentrionalis</i> Lorenz) crack and eat the seed and even break up cones to extract the seed." ... "Mice ( <i>Mus musculus</i> L.) and possibly rats ( <i>Rattus ,attus</i> L.) are thought to eat considerable quantities of seed and recently germinated seedlings (I. L. Barton, pers. comm.)."
801	Prolific seed production (>1000/m <sup>2</sup> )	n
	Source(s)	Notes
	Enright, N. J., & Cameron, E. K. (1988). The soil seed bank of a kauri ( <i>Agathis australis</i> ) forest remnant near Auckland, New Zealand. New Zealand Journal of Botany, 26(2): 223-236	[ <i>Agathis australis</i> seeds did not make up a major component of the seed bank] "A total of 46 vascular plant species, and 908 individuals, were recorded from tray and sub-tray samples. Species composition of trays and sub-trays varies markedly. Trays are dominated by four woody, native species; <i>Kunzea ericoides</i> , <i>Coprosma arborea</i> , <i>Myrsine australis</i> , and <i>Carpodetus serratus</i> ." ... "The total of 1131 m <sup>-2</sup> is similar to estimates obtained for other New Zealand forest sites (Ogden 1985), and to estimates for many temperate and tropical forests elsewhere."
	Sem, G., & Enright, N. J. (1995). The soil seed bank in <i>Agathis australis</i> (D. Don) Lindl.(kauri) forests of northern New Zealand. New Zealand Journal of Botany, 33(2): 221-235	[No evidence that <i>Agathis australis</i> produces such seed densities] "The characteristics of soil seed banks in <i>Agathis australis</i> (kauri) forests of northern New Zealand are presented, and variations in seed bank composition are described in relation to stand age and distance from forest edges. A mean viable seed density of 1118±217/m <sup>2</sup> was present under the kauri forest sites. While the seed bank contained both native (77%) and adventive species (23%), its composition was not closely related to that of the extant vegetation."
802	Evidence that a persistent propagule bank is formed (>1 yr)	n

Qsn #	Question	Answer
	<b>Source(s)</b>	<b>Notes</b>
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. New Zealand Journal of Botany, 20(1): 17-36	"Preest stored kauri seed in airtight containers for up to 11.7 years at moisture contents of 6%, 10%, 15% and 20% oven-dry weight and at constant temperatures of -10°, 5°, 10°, 15°, and 20°C. He showed that kauri seed can be kept for 5-6 years with viability little impaired and probably more than 12 years with viability retained, if stored airtight with low moisture content and temperature. Kauri seed suffered serious loss of viability if both moisture content and temperature were high."
	Enright, N. J., & Cameron, E. K. (1988). The soil seed bank of a kauri ( <i>Agathis australis</i> ) forest remnant near Auckland, New Zealand. New Zealand Journal of Botany, 26(2): 223-236	"Species fruiting in autumn, and characterised by short-lived seed, are most likely to be absent from tray samples, Kauri is an example of this; cones ripen and fall in March, April, and May, seeds remaining viable for only 6-8 weeks (Mirams 1957). Thus, by late July, no viable seed of this species will be available, even directly beneath parent trees."
	Mirams, R. V. (1957). Aspects of the natural regeneration of the kauri ( <i>Agathis australis</i> Salisb.). Transactions of the Royal Society of New Zealand 84(4): 661-680	"There is a steady fall in the germination of kauri seed from 100% at the time of collection to only 5% in mid-July, four and a-half months later; and by mid-November, it is down to less than 1 %. The results obtained by the rapid viability test methods, although somewhat higher, show the same trend as the actual germinations. It is evident from these results that the viability of kauri seed drops rapidly when the seed is stored under ordinary atmospheric conditions."

803	<b>Well controlled by herbicides</b>	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. (2024). Personal Communication	Unknown. No information on herbicide efficacy or chemical control of this species

804	<b>Tolerates, or benefits from, mutilation, cultivation, or fire</b>	<b>n</b>
	<b>Source(s)</b>	<b>Notes</b>
	CAB International. (2005). Forestry Compendium. CAB International, Wallingford, UK	"Fire has been the greatest cause of destruction of <i>A. australis</i> forest and was often associated with logging, land clearing for farms, or recovery of kauri gum from surface or subfossil deposits. Scrub and secondary forests with <i>A. australis</i> regeneration remain vulnerable to fire damage."
	Ecroyd, C. E. (1982). Biological flora of New Zealand 8. <i>Agathis australis</i> (D. Don) Lindl.(Araucariaceae) Kauri. New Zealand Journal of Botany, 20(1): 17-36	"Fires have been the major cause of destruction to stands of kauri over the past 150 years (Reed 1953). The mound of debris (gum, bark, and leaves) at the base of a mature kauri is inflammable during dry periods and if it catches fire the tree is usually killed (Kensington 1909). Stands of kauri are 1 of the few New Zealand forest types prone to fire damage as virgin forest. There is evidence that primaeval kauri forests were destroyed by fire and (near Auckland) volcanic activity (Beveridge 1977). Ground fires will readily kill seedling and sapling kauri as they will most New Zealand tree species; however, pole-sized trees can survive a quickly burning ground fire. Fires were particularly common in logged kauri forest, many being deliberately lit by gum diggers."

805	<b>Effective natural enemies present locally (e.g. introduced biocontrol agents)</b>	
	<b>Source(s)</b>	<b>Notes</b>
	WRA Specialist. (2024). Personal Communication	Unknown

**Summary of Risk Traits:**

Kauri is a tall, stately tree. Native to New Zealand, it is the most massive tree in the whole world by volume. This ancient tree developed around the Jurassic period and has made a niche for itself over the millennia. The tree drops acidic leaf litter that decomposes under the tree. As the acidic litter is washed by rainfall through the soil, it releases trapped nutrients that the tree then takes up through its fine root hairs. This process leaves the ground near these trees a grey color rendering other plants in the area nutrient deficient. Often these trees make up small monotypic stands called kauri forests.

**High Risk / Undesirable Traits**

- Able to grow in subtropical climates
- Possesses allelopathic properties
- Moderately flammable, & could increase fire risk in fire prone areas
- Tolerates many soil types
- Forms dense stands in native range
- Reproduces by seed
- Seeds dispersed by wind (short distances) & intentionally by people

**Low Risk Traits**

- No reports of invasiveness or naturalization to date
- Unarmed (no spines, thorns or burrs)
- Palatable to animals
- Non-toxic
- Shade-intolerant (except for small seedlings)
- Does not hybridize with other *Agathis* species
- Self-incompatible
- Reaches maturity in 15-50 years
- Not reported to spread vegetatively
- Limited dispersibility of wind-dispersed seeds
- Does not form a persistent seed bank
- Fire-intolerant

